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(54) **HEAT SINK FOR LED LUMINAIRE**

(71) Applicant: **General Electric Company**, Schenectady, NY (US)

(72) Inventors: **Péter Jezsoviczki**, Budapest (HU); **Georgina Ambruska**, Budapest (HU); **János Simonovics**, Budapest (HU); **Jozsef Samu**, Budapest (HU); **Thomas Knapp**, Cleveland, OH (US)

(73) Assignee: **GENERAL ELECTRIC COMPANY**, Schenectady, NY (US)

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(51) **Int. Cl.**

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F21V 29/76	(2015.01)
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F21V 23/02	(2006.01)
F21V 29/73	(2015.01)
F21V 19/02	(2006.01)
F21Y 103/00	(2006.01)

(52) **U.S. Cl.**

CPC ***F21V 29/763*** (2015.01); ***F21S 4/008*** (2013.01); ***F21V 23/026*** (2013.01); ***F21V 29/73*** (2015.01); *F21V 19/02* (2013.01); *F21Y 2103/003* (2013.01)

(58) **Field of Classification Search**

CPC F21S 8/02; F21V 17/00; F21V 29/022; F21V 29/2206; F21V 29/2281; F21V 29/267; F21V 21/04; F21V 21/042; F21V 21/045; F21V 1/06

USPC 362/581, 580, 547, 126, 264, 294, 345, 362/373, 217.01–225; 439/238, 261, 286, 439/312

See application file for complete search history.

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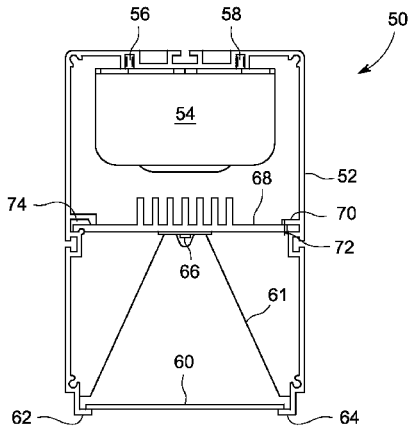
Primary Examiner — Jong-Suk (James) Lee
Assistant Examiner — Christopher E Dunay
(74) *Attorney, Agent, or Firm* — GE Global Patent Operation; Peter T. DiMauro

(57) **ABSTRACT**

An LED luminaire assembly which allows for the easy and safe removal and replacement of the PSU and other internal components wherein the heat sink can be folded or pivoted aside to allow access to and removal of the PSU.

14 Claims, 7 Drawing Sheets



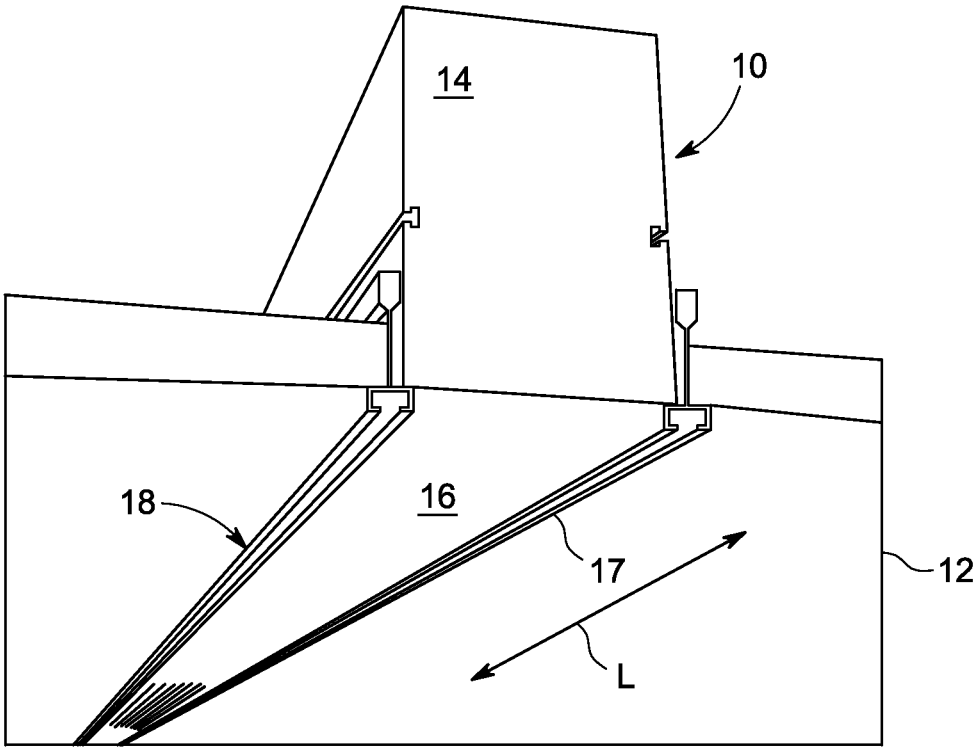


FIG. 1
(PRIOR ART)

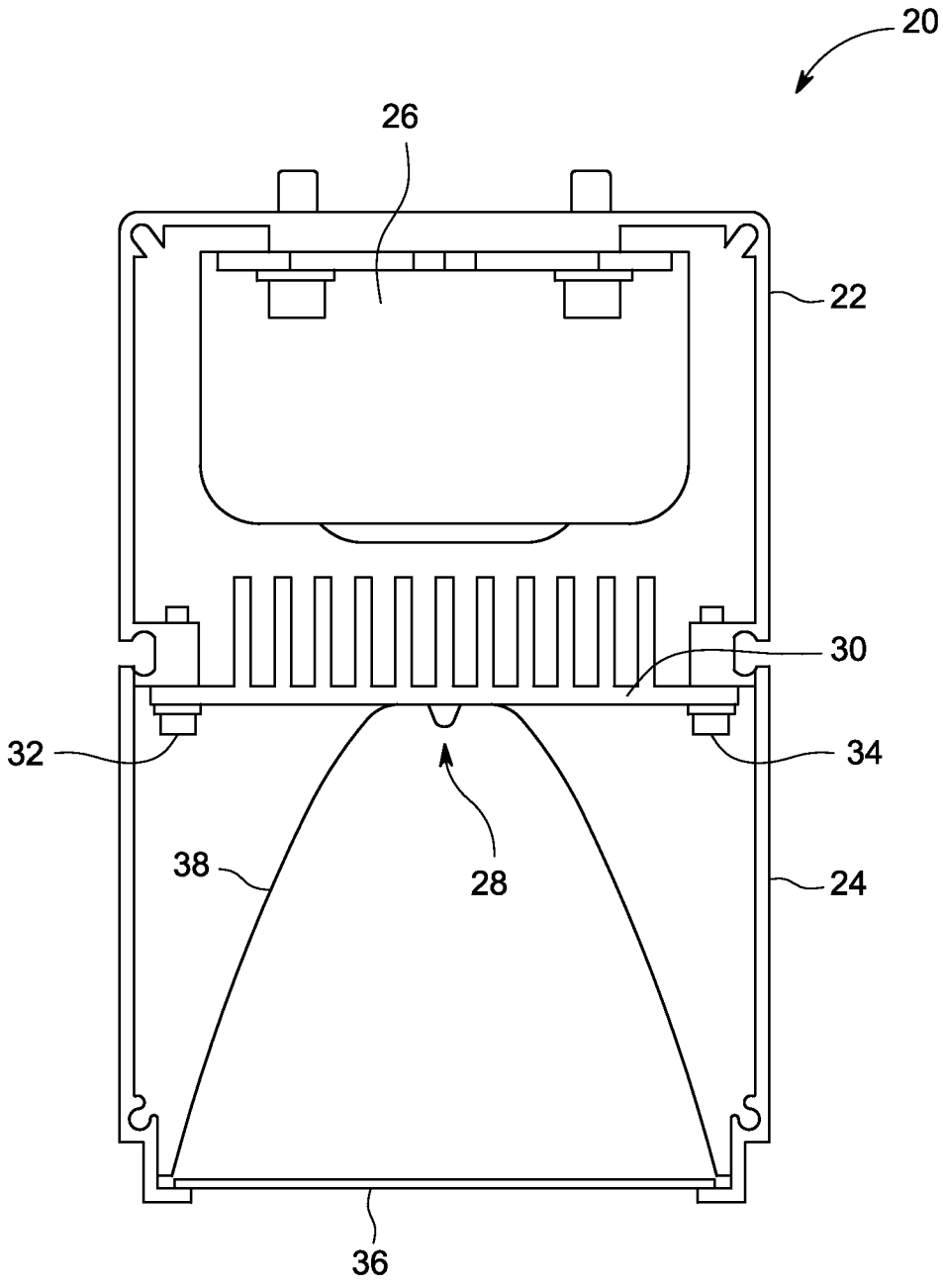


FIG. 2
(PRIOR ART)

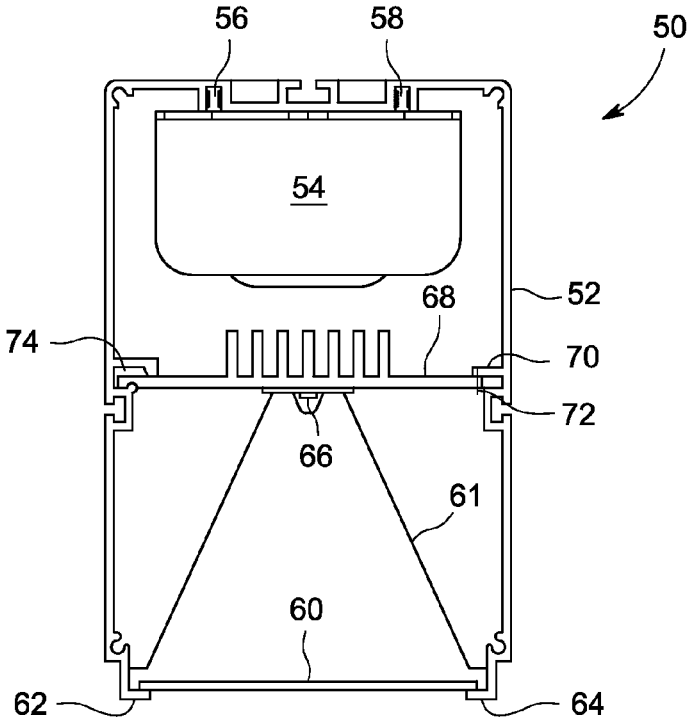

56
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FIG. 3

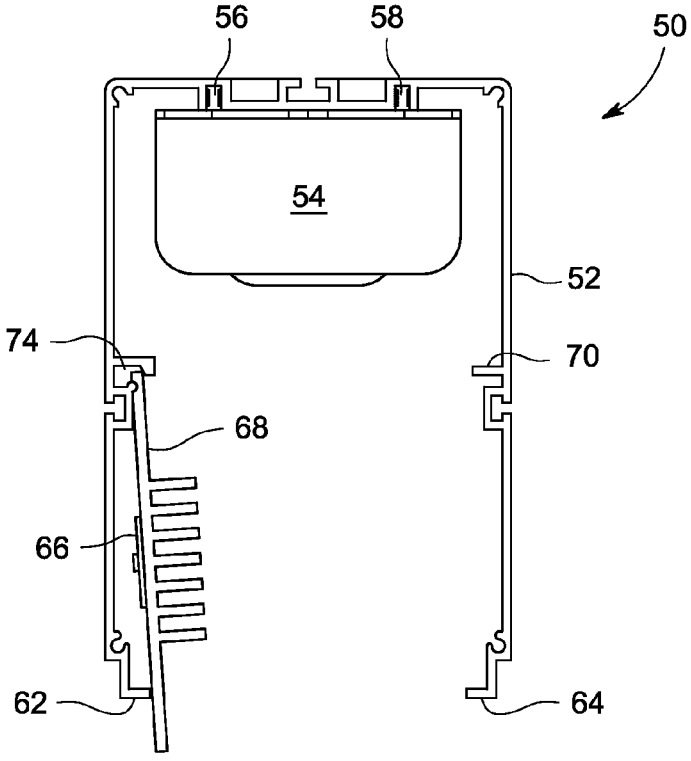
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FIG. 4

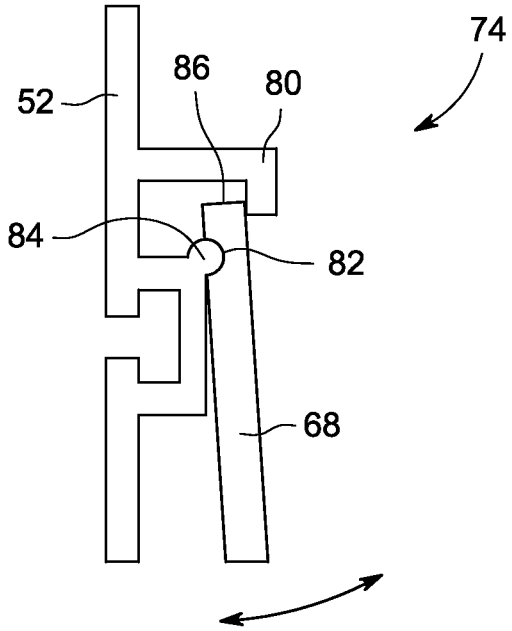

FIG. 5

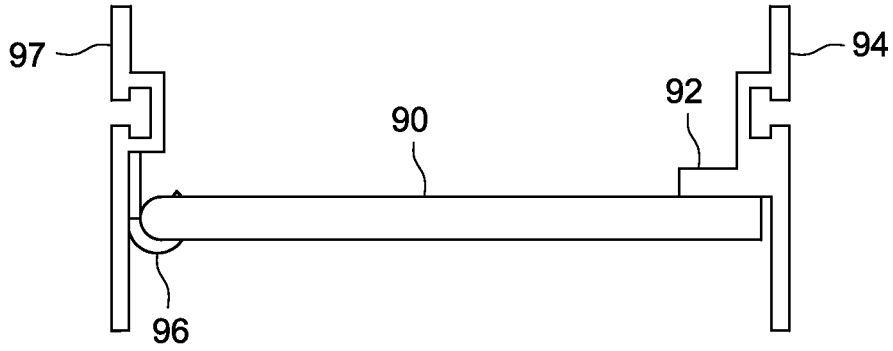

FIG. 6

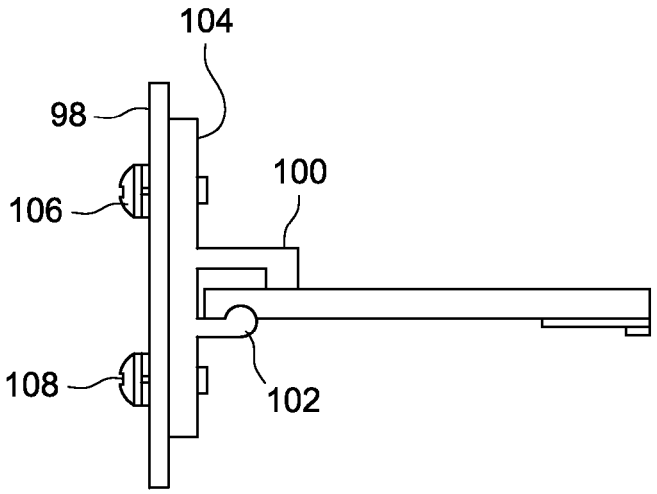

FIG. 7

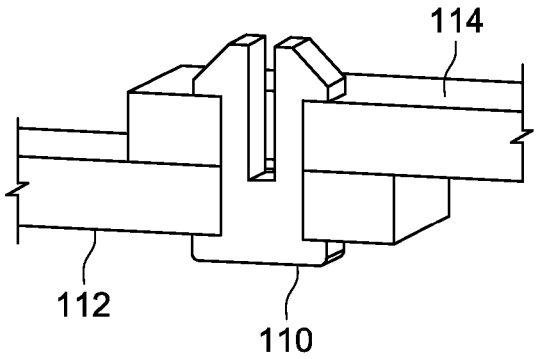

FIG. 8

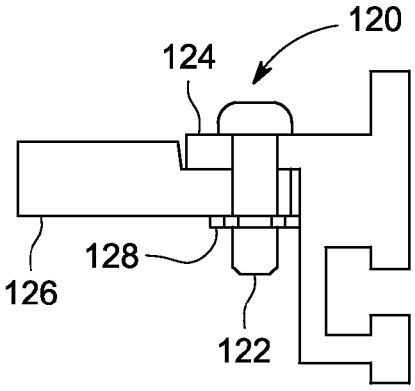

FIG. 9

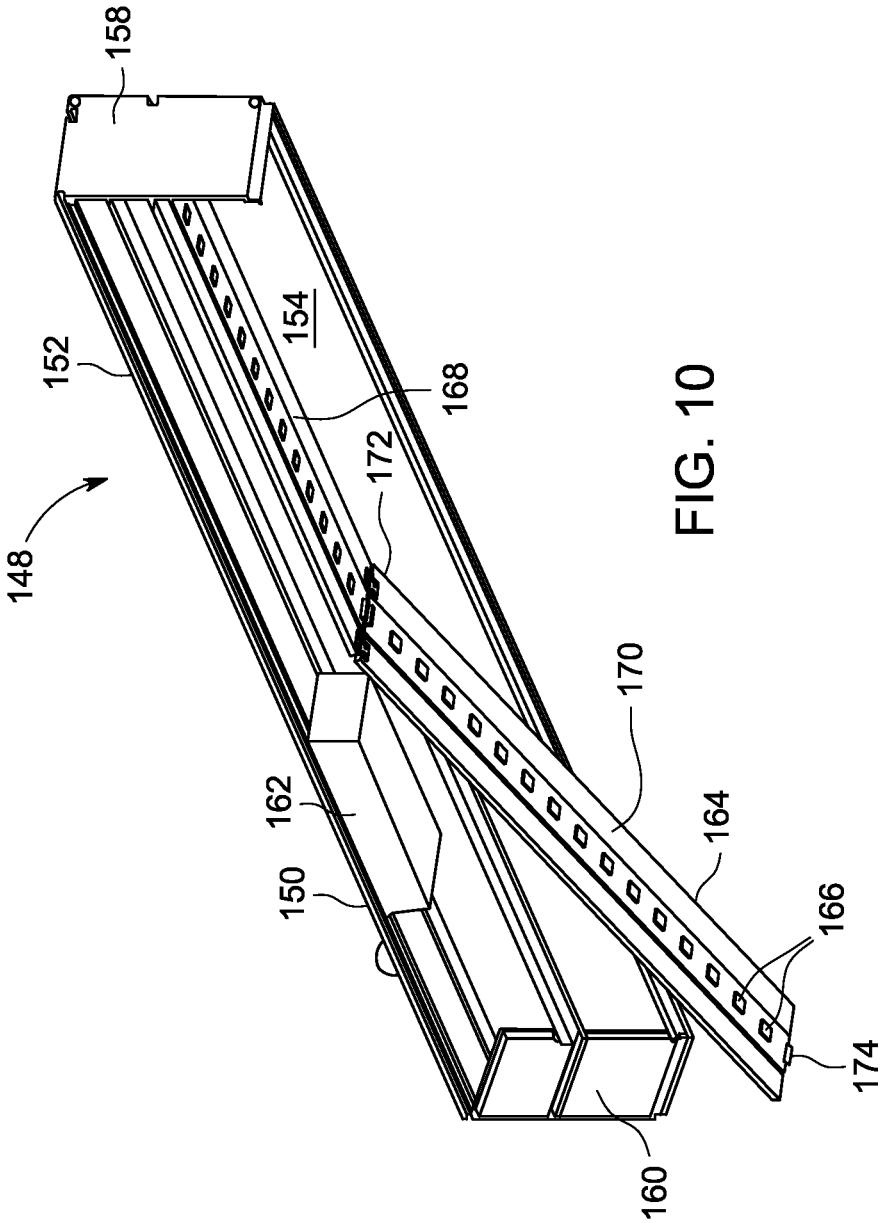

FIG. 10

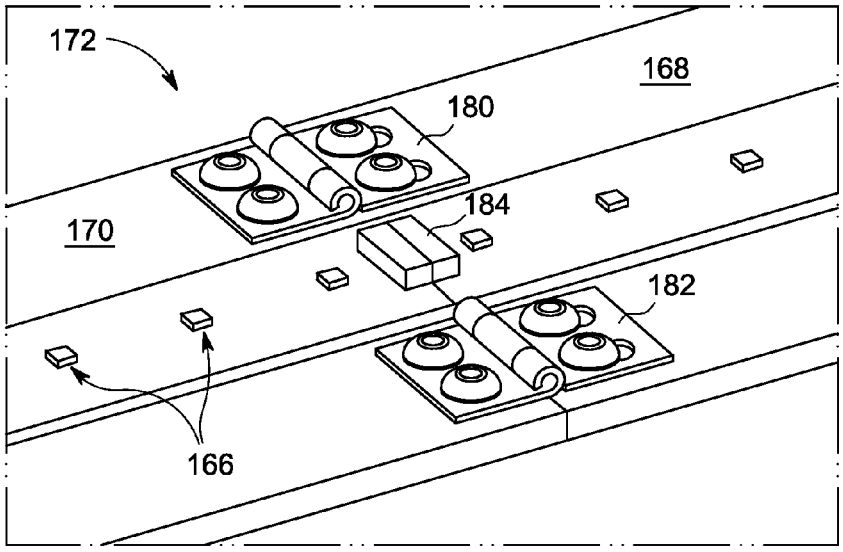

FIG. 11

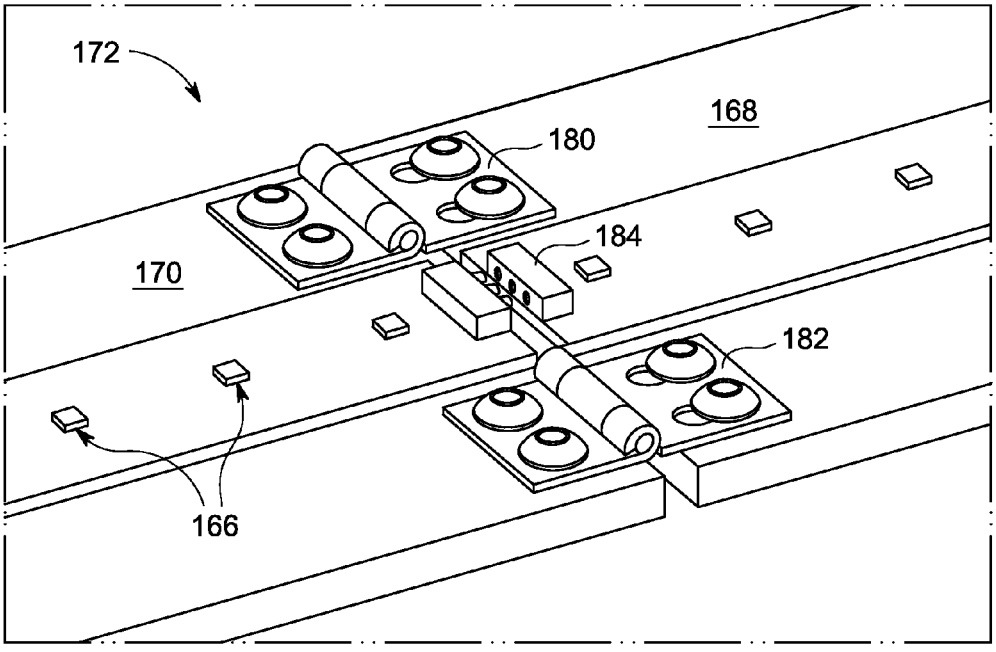

FIG. 12

HEAT SINK FOR LED LUMINAIRE

I. FIELD OF THE INVENTION

The present disclosure relates generally to LED luminaires and particularly to recessed or suspended ceiling and wall mounted LED luminaires. More particularly, the present disclosure relates to a system and method for replacing the power supply unit (PSU) and other internal components of a recessed or suspended ceiling or wall mounted LED luminaire.

II. BACKGROUND OF THE INVENTION

LED luminaires that are recessed in a drop ceiling include a housing that can be fitted into common ceiling grid systems. The housing is commonly an extruded aluminum outer shell that is able to lay on the edge of the ceiling grids. The housing encloses the PSU and the LED module, which is generally attached to a heat sink. The housing also encloses any reflectors that are used in the luminaire as well as a diffuser which generally forms the floor of the housing.

FIG. **1** is an example of a prior art luminaire **10** recessed in a ceiling **12**. The luminaire includes an elongated housing **14** having a top wall (not shown), two side walls (only one partially shown), and two end walls (one shown). The bottom of the housing is enclosed by a diffuser **16**. Diffuser **16** is held in place by retaining lips **17**, **18** which run along length "l" of the lower edge of the housing **14**.

A prior art LED luminaire **20** is shown in FIG. **2** in cross-section. The luminaire **20** includes a housing having two regions, top region **22** and bottom region **24**. Power supply unit **26** is mounted to the inside surface of the top housing region **22**. LED module **28** is mounted to the underside of heat sink **30** which in turn is mounted with two rows of screws **32**, **34** so that it is between the top housing region **22** and bottom housing region **24**. A diffuser **36** sits in the opening of bottom housing region **24** and reflectors **38** fit within bottom housing region **24** between the LED module **28** and the diffuser **36**.

In order to access and replace the PSU **26** of the prior art luminaire **20**, the diffuser **36**, reflectors **38**, and heat sink **30** must first be removed. The diffuser **36** and reflectors **38** are lightweight and relatively simple elements to remove. However the heat sink **30** is heavy and it is awkward to unfasten screws **32**, **34** and lower the heat sink from the luminaire. Moreover, heat sink **30** has mounted thereto the LED module **28** which is quite fragile and must be carefully handled to avoid damage. Furthermore, any wiring between the LED module **28** and the PSU **26** must be disconnected in order to remove and replace the PSU **26**.

In other words, to remove the heat sink **30** from the prior art luminaire **20**, the two rows of screws **32**, **34** are removed to release the heat sink **30**. The heat sink **30**, along with any wiring connecting the heat sink **30**, LED module **28**, and the PSU **26**, is then carefully removed. The PSU **26** is then exposed and can be removed and replaced.

Issues with the prior art assembly are evident. The LED module can be damaged during the removal and temporary storage of the heat sink. The heat sink is heavy and awkward and its removal from the housing can be dangerous.

The above-described shortcomings significantly limit the usefulness of field-serviceable LED luminaires (i.e. luminaires having a replaceable PSU). Therefore, there remains a need for an LED luminaire assembly which allows for the easy and safe removal and replacement of the PSU and other internal components.

III. SUMMARY OF THE INVENTION

In at least one aspect, the present disclosure provides a field serviceable solid state lighting device luminaire assembly which allows for the easy and safe removal and replacement of the power supply unit and other internal components.

In at least another aspect, the present disclosure provides a solid state lighting device luminaire assembly wherein the heat sink can be folded aside to allow access to and removal of the PSU.

The present disclosure describes a solid state lighting device luminaire assembly having a housing with a first side wall, a second side wall, a first end wall, and a second end wall and a power supply unit located within the housing. The solid state lighting device module is connected to a heat sink which blocks access to the power supply unit. The heat sink folds or pivots to allow access to the power supply unit.

In one aspect the heat sink extends across the housing and is attached to the first side wall of the housing with a fixed attachment and to the second side wall of the housing with a pivot attachment so that when the fixed attachment is disconnected the heat sink stays attached to the housing at the pivot attachment and pivots towards the second side wall. When the heat sink is pivoted the power supply unit is exposed.

In another aspect, the heat sink extends across the housing and is attached to the first end wall with a fixed attachment and to the second end wall with a removable attachment and the heat sink includes at least two segments connected by a hinged connection. The heat sink can be unattached from the second end wall and folded at the hinged connection to expose the power supply unit.

IV. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a prior art ceiling mounted luminaire.

FIG. **2** illustrates a schematic view of a prior art LED luminaire.

FIG. **3** illustrates a schematic view of an LED luminaire assembly in accordance with at least one embodiment of the present disclosure.

FIG. **4** is another schematic view of the LED luminaire assembly with the heat sink pivoted to allow access to the PSU.

FIG. **5** is an up-close view of the pivot attachment of the heat sink to the housing.

FIG. **6** is a view of another embodiment of a pivot attachment of the heat sink to the housing using a hook mechanism.

FIG. **7** is a view of another embodiment of a pivot attachment of the heat sink to the housing wherein the pivot mechanism is not an integral part of the housing.

FIG. **8** is a view of another embodiment of the fixed attachment of the heat sink to the housing using a snap-fit fastener.

FIG. **9** is a view of another embodiment of the fixed attachment of the heat sink to the housing using a pin and snap ring.

FIG. **10** illustrates an LED luminaire where the LED module is attached to a heat sink which is hinged on an alternative axis.

FIG. **11** illustrates one embodiment of a hinged connection between permanent and removable segments of a heat sink.

FIG. **12** illustrates the hinged connection of FIG. **11** in disengaged status.

The present disclosure may take form in various components and arrangements of components, and in various process operations and arrangements of process operations. The present disclosure is illustrated in the accompanying drawings, throughout which like reference numerals may indicate corresponding or similar parts in the various figures. The

drawings are only for purposes of illustrating preferred embodiments and are not to be construed as limiting the disclosure. Given the following enabling description of the drawings, the novel aspects of the present disclosure should become evident to a person of ordinary skill in the art.

V. DETAILED DESCRIPTION

The following detailed description is merely exemplary in nature and is not intended to limit the applications and uses disclosed herein. Further, there is no intention to be bound by any theory presented in the preceding background or summary or the following detailed description. While embodiments of the present technology are described herein primarily in connection with LED luminaires for use in recessed drop ceilings, the concepts are also applicable to other types of LED luminaires and luminaires having other light sources. In addition, while the invention is described herein as applicable to LED luminaires it should be understood that it is applicable to other solid-state lighting devices as well. For example light-emitting transistors or organic light-emitting diodes/devices (OLEDs) are applicable alternative SSL devices.

In at least one aspect, the present disclosure provides an LED luminaire assembly. As shown in FIG. **3**, the LED luminaire **50** includes a single piece housing **52** which is extruded aluminum, another metal, or plastic. The PSU **54** is mounted to the inside of the housing **52** such as with two rows of bolts **56**, **58**.

Diffuser **60** is held by inner pointing retaining lips **62**, **64** that run the length of the lower edge of the housing **52**. Similar retaining lips **17**, **18** are shown for the prior art luminaire shown in FIG. **1** running along length "l" of the lower edge of the housing **14**.

LED module **66** is mounted on the underside of heat sink **68** by screws, adhesives, or other means (not shown). Heat sink **68** is held in place on one side by fixed attachment to an inwardly directed lip **70** with screws or bolts **72** or temporary or quick release mechanisms such as magnets, tethers, chains, levers, pins, or clevis fasteners. The other edge of heat sink **68** is held in place by a pivoting or hinged attachment **74**.

Heat sink **68** is typically aluminum but can be another thermally conductive metal, thermally conductive plastic, or other plastic. Its thickness generally ranges between about 0.5 to 20 mm.

To remove the PSU **54**, the diffuser **60** and reflector **61** are removed from the luminaire assembly and placed aside. The screws **72** or other fastening devices are removed, allowing the heat sink **68** to hinge or pivot within the housing **52**.

FIG. **4** illustrates the luminaire assembly with the heat sink **68** pivoted to provide access to the PSU **54**. Screws **56**, **58** can be removed, allowing removal of the PSU **54**. The LED module **66** is protected from damage because it is between the heat sink **68** and housing wall **52**. Furthermore, heat sink **68** is prevented from pivoting all the way against the housing wall **52** by the lip **62** which also provides protection to the LED module **66**.

Pivot attachment **74** is shown in more detail in FIG. **5**. In this embodiment, the pivot attachment is a longitudinal extruded center of rotation. A retaining finger **80** is extruded as part of housing wall **52**. Heat sink **68** includes a divot **82** in the surface thereof which matches with retaining ball **84**, also extruded as a segment of housing wall **52**. Heat sink **68** rotates around retaining ball **84** on the divot **82** as indicated by the directional arrow and the end **86** of heat sink **68** is retained by retaining finger **80**.

Pivot attachment **74** can be segmental along the inside of housing **52** (one or more mechanisms **74**) or can be a continuous element.

Pivoting attachments can be used other than the embodiment shown by FIGS. **3-5**. For example, other solutions can be a classic door hinge, or a hold open hinge.

FIG. **6** illustrates another embodiment of a pivoting attachment that can be used to provide a pivoting heat sink. The heat sink **90** is fastened on one side to the housing wall inwardly directed lip **92** that is an integral part of the luminaire housing **94**. This fixed attachment can be the same as described for the above embodiment. The other side of the heat sink **90** is fastened to the luminaire housing **97** via one or more hooks **96** extending through one or more holes of the heat sink **90**. When the heat sink **90** is loosened from the one side it swings or pivots providing access to the PSU.

FIG. **7** illustrates a pivot attachment similar to that shown in FIGS. **3-5** except that the mechanism is not an integral part of the housing **98**. Instead the retaining finger **100** and retaining ball **102** are a pivot unit **104** attached to the housing **98** with screws or such **106**, **108** or welded to the housing **98**.

Heat sink **68** can be attached to housing **52** on its non-pivoting side in a number of ways. One embodiment is shown in FIGS. **3-6**. FIG. **8** illustrates another embodiment of a fixed attachment, wherein a snap-fit fastener **110** is used to fasten the heat sink **112** to the housing retaining lip **114**.

FIG. **9** illustrates yet another embodiment of a fastening means **120** having a pin **122** that extends through the retaining lip **124** and the heat sink **126** and is kept in position by a snap ring **128**.

A number of other fastening devices can be used including screws, bolts, slide bolt latches, magnets, rivets, cotter pins, leaf springs, or wedges.

A second embodiment of a field serviceable luminaire assembly **148** is illustrated in FIG. **10**. This embodiment includes a heat sink **164** that folds crosswise to provide access to the power supply unit **162**, rather than pivoting lengthwise to provide access as in the previously described embodiment.

As shown in FIG. **10**, this embodiment includes a housing **150** with a top panel **152**, first side panel **154**, second side panel (not shown in this view), and end walls **158**, **160**. Power supply unit (PSU) **162** is mounted to the top panel **152**. Heat sink **164** has a plurality of LED modules **166** mounted thereto. Heat sink **164** has two connected, hinged segments, a permanent segment **168** and a removable segment **170**. Segments **168**, **170** appear to be shown as being of equal length but they can be of unequal length or the heat sink **164** can be divided into more than two segments. Segment **170** is shown folded in FIG. **10**, so that the power supply unit **162** is exposed.

It should also be noted that the luminaire **148** could have multiple power supplies or there may be other components, such as controllers, sensors, terminal blocks, etc. that the service-operator may need to access. Also, the pivoting segment need not be attached at an end of the housing **150**. There may be three (or more) segments with the pivoting segment in the middle, for example.

Heat sink **164** is shown with segment **170** folded downwards. In use, heat sink **164** is mounted within housing **150** generally from one end wall **158** to the other end wall **160** and from side wall **154** to the opposite side wall (not shown). The permanent segment is mounted with screws, adhesive, or other attachment means to the housing. The removable segment **170** is attached to the permanent segment **168** with a hinged connection **172** and is attached to the inside of the end wall **160** with a tab **174** which mates in a slot (not shown) on

the end wall **160**. Other methods of removably attaching the removable segment **170** can be employed.

It should be noted that the hinged connection **172** should accommodate any electrical connections between segments **168** and **170**. One embodiment of an appropriate hinged connection **172** is shown in FIGS. **11** and **12**. As shown in FIG. **11**, the permanent segment **168** and removable segment **170** are connected with two slotted hinges **180**, **182**. Electrical connection between permanent segment **168** and removable segment **170** is made with a connector **184**. To disconnect and fold the removable segment **170** it is first pulled to disengage the connector **184** (this step is shown in FIG. **12**) and the slotted hinges allow movement of the removable segment **170** away from the permanent segment **168**. The removable segment **170** can then be folded as shown in FIG. **10**.

The electrical connection between heat sink sections could be a pin connector, ribbon cable, flexible wire, or flexible printed-circuit board. Alternatively, the entire heat sink could be a flexible circuit board that has enough slack at the hinged joint that it can pivot without damaging the board. In that embodiment, a slotted hinge would not be necessary and a standard hinge or other pivoting mechanism would suffice.

This embodiment will desirably include reflectors and these must be removed to access the removable segment **170** of the heat sink **164**. The removable segment **170** is then folded down and the power supply unit **162** can be serviced or removed.

Alternative embodiments, examples, and modifications which would still be encompassed by the disclosure may be made by those skilled in the art, particularly in light of the foregoing teachings. Further, it should be understood that the terminology used to describe the disclosure is intended to be in the nature of words of description rather than of limitation.

Those skilled in the art will also appreciate that various adaptations and modifications of the preferred and alternative embodiments described above can be configured without departing from the scope and spirit of the disclosure. Therefore, it is to be understood that, within the scope of the appended claims, the disclosure may be practiced other than as specifically described herein.

We claim:

1. A luminaire assembly comprising:
- a housing comprising a first side wall, a second side wall, a first end wall, a second end wall, and an upper wall;
- a power supply unit located within the housing;
- a heat sink extending across the housing;
- a solid state lighting device module connected to the heat sink;
- wherein the heat sink is attached to at least the first side wall of the housing;
- wherein the heat sink is configured to pivot or fold to allow access to the power supply unit; and
- wherein the heat sink blocks access to the power supply unit such that the power supply unit is inaccessible when the heat sink is not folded.

2. The luminaire assembly of claim **1**, wherein the heat sink is attached to first side wall of the housing with a fixed attachment.

3. The luminaire assembly of claim **2**, wherein the power supply unit can be removed from the luminaire when the heat sink is folded.

4. The luminaire assembly of claim **1**, wherein the heat sink is configured to fold using at least one pivot attachment.

5. The luminaire assembly of claim **4**, wherein the at least one pivot attachment is disposed on the heat sink.

6. The luminaire assembly of claim **4**, wherein the heat sink extends across the housing and is attached at the first end wall with a fixed attachment and at the second end wall with a removable attachment.

7. The luminaire assembly of claim **4**, wherein the heat sink comprises a first segment affixed to the first end wall and a second segment removably attached to the second end wall.

8. The luminaire assembly of claim **7**, wherein the first segment and the second segment are joined with a hinged connector.

9. The luminaire assembly of claim **1**, wherein the heat sink comprises a first segment affixed to the first end wall and a second segment removably attached to the second end wall, and a third segment that is connected to at least one of the first segment and the second segment with a hinged connector.

10. A luminaire assembly comprising:
- a housing comprising a first side wall, a second side wall, a first end wall, a second end wall, and an upper wall;
- a power supply unit located within the housing;
- a heat sink extending across the housing and attached to the first side wall and the second side wall; and
- a lighting module connected to the heat sink;
- wherein the heat sink is configured to pivot or fold to allow access to the power supply unit;
- wherein the heat sink blocks access to the power supply unit such that the power supply unit is inaccessible when the heat sink is not folded and accessible when folded; and
- wherein the heat sink comprises a plurality of segments.

11. The luminaire assembly of claim **10**, wherein the power supply unit can be removed from the luminaire when the heat sink is folded.

12. The luminaire assembly of claim **1**, wherein the heat sink has two connected hinged segments, a permanent segment, and a removable segment.

13. The luminaire assembly of claim **10**, wherein at least two segments of the plurality of segments are joined by a connector providing electrical connectivity to the lighting module.

14. The luminaire assembly of claim **13**, wherein the heat sink is configured to fold when the connector is mechanically disengaged.

* * * * *